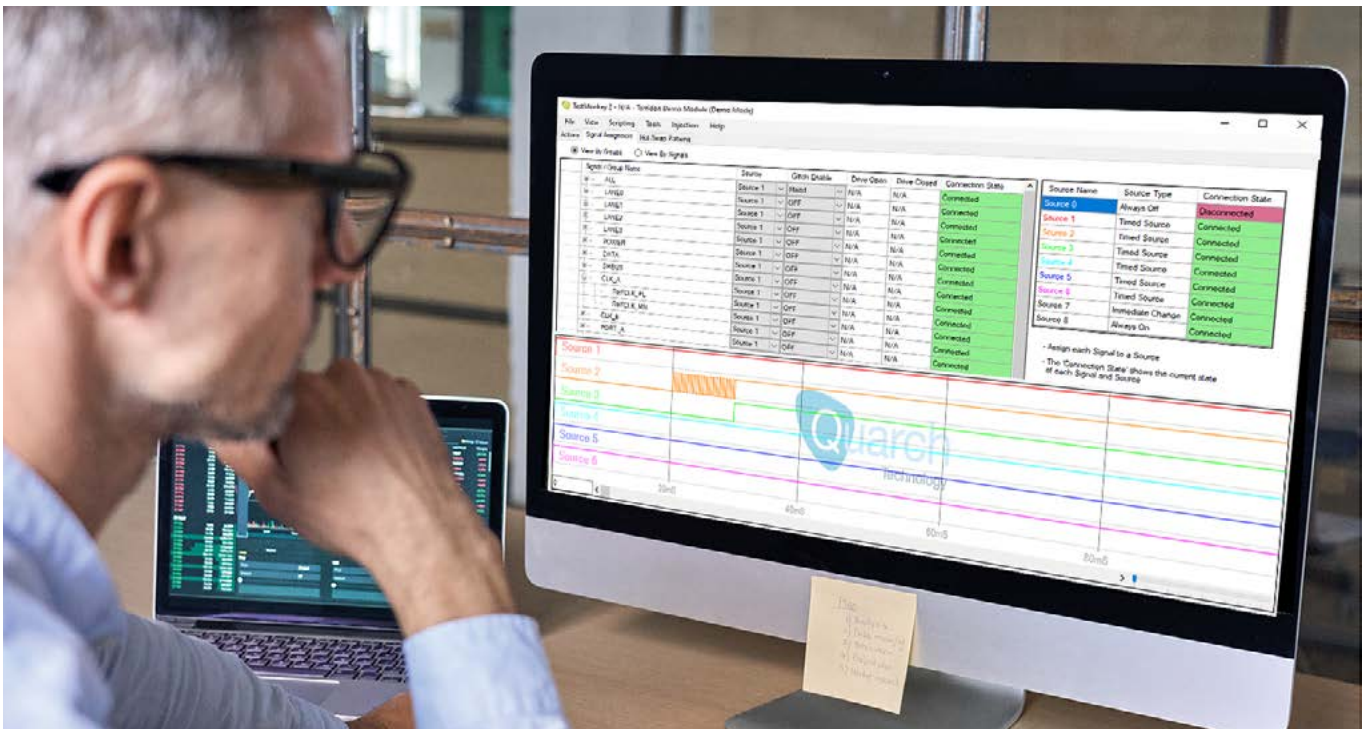
Quarch Technology

Product Guide

Torridon System



Torridon System - Breakers

HOT-PLUG AND PHYSICAL LAYER FAULT INJECTION

INDUSTRY LEADING AUTOMATED TESTING

Quarch.com Data Storage I Automotive I Telecoms I Aerospace

Aviemore, Scotland

CONTENTS

Product Range Overview

The Torridon system is modular and made up of 'controllers' that run the system and 'breaker modules' that sit in the interface under test.

Automate hot-plug, link width configuration, PERST assertion, REFCLK fault, data error injection and many more physical layer tests.

Run one manual test with a couple of clicks in our TestMonkey app, or automate hundreds with our simple Python API.

Automate a single drive on a bench, or scale up to entire storage arrays

Supports all major device interfaces: SAS, SATA, PCIe. Also supports cable interfaces: USB, LAN, SATA, External PCIe, External SAS and more.

Quarch tools are widely trusted across the industry are included as required testing for Plugfest compliance events.

Quarch Gen6

Our powerful range of breakers come in a variety of speeds including for the latest Gen6 PCIe devices and support PCIe, CXL and OCP.

WHAT'S CHANGED FOR GEN6?

Find out more

For Gen6 devices, all breakers will include a full feature set with capabilities such as high-resolution hot-plug timings, pin bounce, sideband driving, and glitching, making them compatible with PCIe, NVMe, CXL, and OCP. The main differences lie in their control over PCIe data lanes.

The Gen6 breakers come in various lane options:

x16-16 has individual RF switches for all 16 lanes

x8-8 manages 8 lanes in an x16 slot, all switched

x16-1 switches only Lane 0 with the remaining directly routed.

x16-0 has 16 lanes, all directly routed

All variants support driving, monitoring, bounce, glitch and similar, as found on our full featured Gen5 devices.

Which Gen6 Breaker do I choose?

Gen6 PCIe x16-1 Breaker

Which Gen6 Breaker do I choose?

WHEN DO YOU NOT NEED THE EXPENSIVE OPTION?

Many testing scenarios allow for cost savings by selecting the appropriate product. For lane reduction tests on an x16 switch or device, full lane control with the x16-16 is necessary. However, for tests like SMBUS, power-up sequencing, REFCLK isolation for SRIS, and fault injection, less comprehensive variants suffice.

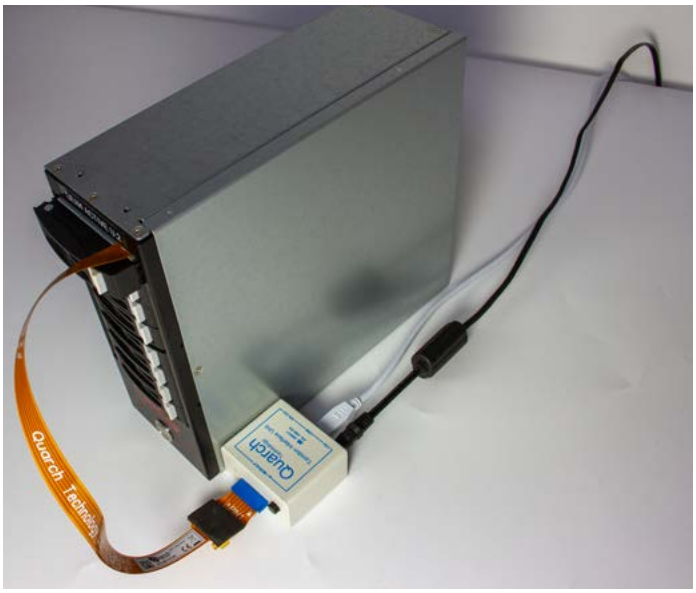
For instance, SMBUS testing can be performed with x16-0 by breaking or locking REFCLK, while power-up sequencing often only needs the x16-1 breaker to delay data lanes until Lane0 activates, which most devices require.

REFCLK testing and fault injection, such as isolating sidebands or applying glitches, can be done with any variant since they don't always require controlling data lanes. All variants include a Programmable Power Module (PPM) port for power margining and measurements.

Understanding each test's requirements helps identify the most cost-effective option without sacrificing necessary control.

TORRIDON INTERFACE KIT

Find out more



Control a single breaker module via USB or Serial.

Ideal for simple bench tests and small scale automation.

INTERFACE KIT: CONTROLS A SINGLE BREAKER ACROSS EITHER: DIRECT USB, USB VIRTUAL COM PORT OR DIRECT RS-232 VIA RS232-D WIRED RJ-45 PORT. 12V 15W SUPPLY.

Torridon controller options

Button switches between direct USB and USB VCOM mode.

12v PSU powers the Breaker, so it is independent of host power.

Rear USB-2 and RJ-45 serial port for control.

4-PORT ARRAY CONTROLLER

Find out more

Control up to 4 Breaker modules at the same time.

1U high and can be front or rear rack mounted with an additional kit.

4-PORT CONTROLLER: CONTROLS 4 BREAKER MODULE ACROSS EITHER: DIRECT USB, LAN OR DIRECT RS-232 VIA RS232-D WIRED RJ-45 PORT. 12V 60W SUPPLY.

Torridon controller options

USB, LAN and RS232 Serial control ports.

12v PSU powers the Breakers, so they are independent of host power.

Link port allows two controllers to be chained for 8 device control.

28-PORT ARRAY CONTROLLER

Find out more

28-PORT CONTROLLER: CONTROLS 28 BREAKER MODULE ACROSS EITHER: DIRECT USB, LAN OR DIRECT RS-232 VIA RS232-D WIRED RJ-45 PORT. 24 PORTS ON FRONT, 4 PORTS ON REAR. 12V 60W SUPPLY. RACK MOUNTS IN 1U. ADDITIONAL USB PORT ON FRONT

Torridon controller options

USB, LAN and RS232 Serial control ports.

12v PSU powers the Breakers, so they are independent of host power.

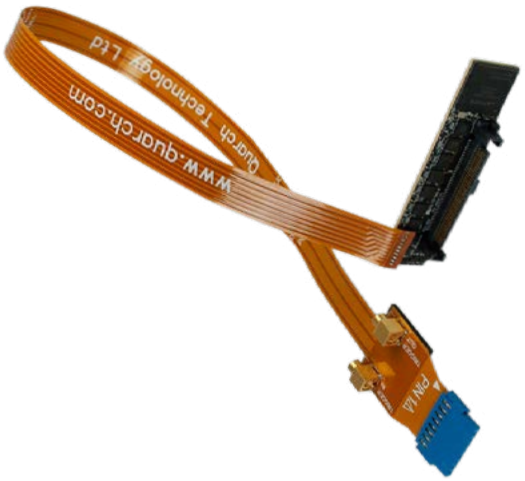
Link port allows two controllers to be chained for 48 device control.

Rear ports are ideal for cable breaker modules.

HIGH SPEED BREAKERS

Find out more

- Individual switching of all pins (excluding grounds)
- Multi-stage hot-plug and pin-bounce generator with 1uS resolution
- Glitch generator with 50nS minimum period. PRBS generator for random glitch generation
- Driving and monitoring of major sidebands
- Triggering versions available with external trigger in/out
- Some Gen6 versions have directly routed lanes



BREAKERS: FET SWITCHES ON POWER RAILS, HIGH SPEED RF SWITCHES ON PCIE LANES WITH INDIVIDUAL CONTROL ON EVERY PIN, DIGITAL SWITCHING ON SIDEBANDS. GROUNDS ARE PERMANENTLY CONNECTED. 1US TIMING RESOLUTION ON HOT-PLUG SIMULATION. 50NS MINIMUM GLITCH DURATION ON PCIE LANES. PIN-BOUNCE GENERATOR WITH CUSTOM USER PATTERNS. DRIVING AND MONITORING ON SELECTED SIDEBANDS. VOLTAGE MONITORING ON SELECTED RAILS

Torridon Breaker features

LITE BREAKERS

- Simplified hardware for cost effective hot-plug cycling
- Switching of power and sideband signals
- High speed data signals and grounds are permanently connected
- Multi-stage hot-plug generator with 1mS resolution

LITE BREAKER: FET SWITCHES ON POWER RAILS, DIGITAL SWITCHING ON SIDEBANDS. HIGH SPEED LANES AND GROUNDS ARE PERMANENTLY CONNECTED. 1MS TIMING RESOLUTION ON HOT-PLUG SIMULATION. BASIC HOT-PLUG ONLY, NO PIN-BOUNCE, DRIVING OR GLITCH. VOLTAGE MONITORING ON SELECTED RAILS.

GEN6 EDSFF E1 BREAKERS

Find out more

Optional triggering version has MCX trigger in/out.

Supports E1.S and E1.L drives up to Gen6 speeds

Storage breakers

Find out more

Optional triggering version has MCX trigger in/out.

Supports E3 drives up to Gen6 speeds.

E3 x4, E3 x8 and E3-2T x8 versions available.

E3 BREAKERS: SUPPORTS EDSFF E3 DEVICES UP TO GEN6 SPEEDS, VERSIONS AVAILABLE DIFFER BY LANE WIDTH AND ENCLOSURE SIZE. **E1 SIGNALS:** DRIVE+MONITOR: PERST0, PERST1, PRSNT0, LED, SMBRST, PWRDIS, DUALPORTEN. MONITOR: SMBCLK, SMBDAT. **E3 SIGNALS:** DRIVE+MONITOR: PERST0, PERST1, PRSNT0, PRSNT1, LED, SMBRST, PWRDIS, DUALPORTEN. MONITOR: SMBCLK, SMBDAT, RFU_A42, RFU_B8.

GEN5 SFF U.2 & U.3 BREAKERS

Find out more

Optional triggering versions have MCX trigger in/out.

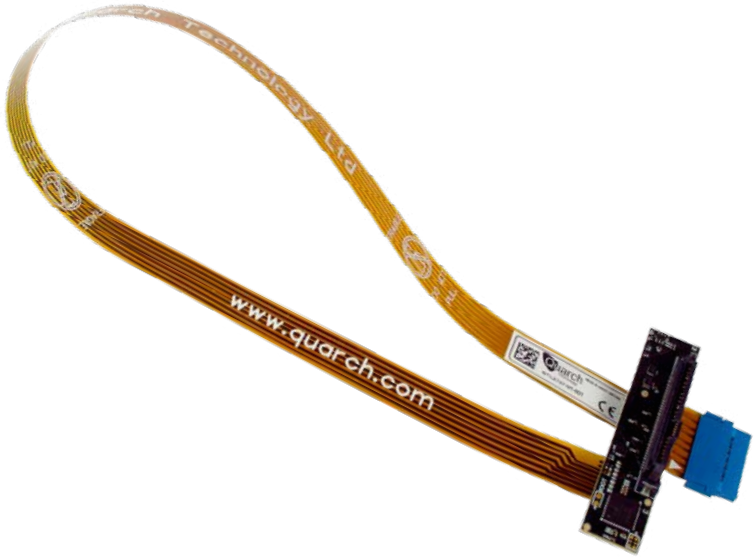
U.2 and U.3 versions, both supporting up to Gen5 speeds.

SFF BREAKERS: SUPPORTS SFF-8639 DEVICES UP TO GEN5 SPEEDS. DUALPORT DRIVES SUPPORTED.
U.2 BREAKER: DRIVE+MONITOR: PERST, CLKREQ/PERSTB, SMCLK, SMDAT, DUALPORTEN, IF_DET, PWR_DIS, PRSNT, HPT0, HPT1. MONITOR: ACTIVITY, WAKE. U.3 BREAKER: DRIVE+MONITOR: PRSNT, PWRDIS, DUALPORTEN, IFDET, IFDET2, HPT0, HPT1, PERST, PERSTB. MONITOR: SMBCLK, SMBDAT, WAKE 8

Storage breakers

GEN5 SFF LITE BREAKER

Find out more



Supports SFF-8639 drives: U.2, U.3, SAS and SATA.

Supports speeds up to Gen5 PCIe and SAS4.

LITE BREAKER: SUPPORTS SFF-8639 U.2 DEVICES UP TO GEN5 SPEEDS. DUALPORT DRIVES SUPPORTED. SUPPORTS ALL SFF-8639 DEVICES INCLUDING U.2, U.3 SAS AND SATA. CONTROLLED SIGNALS: 12V_POWER, 12V_CHARGE, 5V_POWER, 5V_CHARGE, 3V3_AUX, PERST_A, PERST_B, SIDEBAND (ALL OTHER SIDEBANDS).

24G SAS BREAKERS

Find out more

Optional triggering version has MCX trigger in/out.

Supports SAS/SATA drives up to SAS4 speeds

Storage breakers

12G SAS LITE BREAKER

Find out more

Supports SAS/SATA drives up to SAS3 speeds.

SAS LITE BREAKER: SUPPORTS SAS/SATA UP TO SAS3 SPEEDS. CONTROLLED SIGNALS: 5V_CHARGE, 5V_POWER, 12V_CHARGE, 12V_POWER, MATED, POWER_DISABLE.

GEN5 M.2 M-KEY BREAKERS

Find out more

Optional triggering version has MCX trigger in/out.

Supports M.2 M-Key devices up to Gen5 speeds.

Horizontal form factor.

M.2 BREAKERS: SUPPORTS M.2 M-KEY DEVICES UP TO GEN5 SPEEDS. DRIVE+MONITOR: PEWAKE, CLKREQ, LED1, PERST, SUSCLK, ALERT

Storage breakers

GEN6 X16-16 AIC BREAKERS

Find out more

Triggering version has MCX trigger in/out.

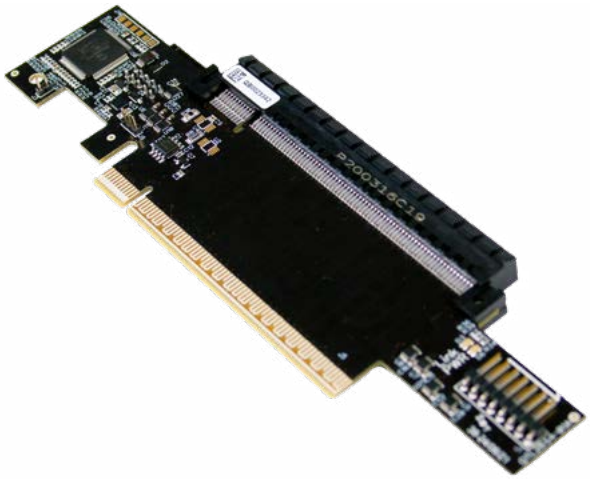
Optional inrush limit version reduces inrush current load on hosts during SSD hot-plug

Power injection port for Programmable Power Module, allowing measurement and margining

AIC BREAKERS: SUPPORTS AIC/SLOT DEVICES WITH UP TO 16 LANES, AND UP TO GEN6 SPEEDS, TRIGGERING AND INRUSHLIMITED VERSIONS ARE AVAILABLE. DRIVE+MONITOR: PERST, WAKE, CLKREQ, PWRBRK. MONITOR ONLY: SMCLK, SMDAT.

GEN5 X16 AIC LITE BREAKERS

Find out more



Supports AIC/slot devices up to Gen5 speeds.

Optional inrush limit version reduces inrush current load on hosts during SSD hot-plug.

Direct USB header to power/ control direct from a host PC.

AIC LITE BREAKERS: SUPPORTS PCIE AIC/SLOT DEVICES UP TO GEN5 SPEEDS. CONTROLLED SIGNALS: 12V_POWER, 3V3_POWER, 3V3_AUX, PRSNT, WAKE, PERST, CLKREQ, REFCLK, JTAG, SMCLK, SMDAT, PWRBRK.

Storage breakers

STORAGE AND BEYOND

Find out more

PCIe breakers support more than just SSDs. The devices are protocol agnostic and support PCIe, NVMe, OCP and CXL devices.

Any device compatible with the interface can be tested, including GPUs, AI accelerators, HBAs, NICs and more.

Not all breakers are shown here, multiple older variants are available on request, including: Keyed SATA SFF, x8 PCIe slot and SCA-40.

AIC BREAKERS: SUPPORTS AIC/SLOT DEVICES WITH UP TO 16 LANES, AND UP TO GEN6 SPEEDS, TRIGGERING AND INRUSHLIMITED VERSIONS ARE AVAILABLE. DRIVE+MONITOR: PERST, WAKE, CLKREQ, PWRBRK. MONITOR ONLY: SMCLK, SMDAT.

ASYMMETRIC BREAKER BENEFITS

Reduce SI losses for Gen5 testing by removing additional adaptors/cables and test direct in a slot

Combine breaker and power analysis features onto a single device for all-in-one testing.

Larger form factor allows additional features on some devices, such as sideband probe points and PAM (Power Analysis Module) functionality with power, sideband and REFCLK monitoring.

Asymmetric breakers

GEN5 AIC TO U.2 ASYMMETRIC BREAKER

Find out more

Supports PCIe U.2 drives up to Gen5 speeds in a PCIe x4 slot.

Optional triggering version with in/out trigger points.

PPM power injection port for Quarch Power Analysis Module.

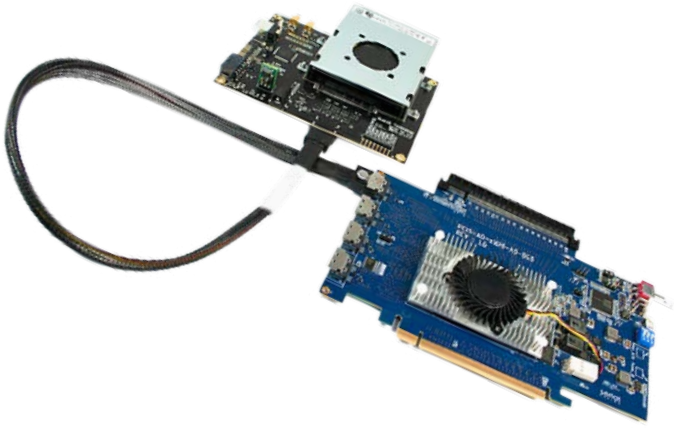
Probe points for selected sidebands

Direct USB control port in addition to Torridon controller.

AIC TO U.2 BREAKER: SUPPORTS U.2 X4 DRIVES UP TO GEN5 SPEEDS, TRIGGERING VERSIONS ARE AVAILABLE. DIRECT USB OR TORRIDON CONTROL PORT. DRIVE+MONITOR: PERST, PERSTB, DUALPORTEN, IF_DET, WAKE, PWR_DIS, HPT0, HPT1. MONITOR: SMCLK, SMDAT, ACTIVITY, PRSNT, IFDET_2, PRSNT1, PWRBRK, RSVD_A19, RSVD_A32, RSVD_P2.

GEN5 MCIO TO U.2 ASYMMETRIC BREAKER

Find out more



Connect to a compatible MCIO host card, removing the need for adaptors or a U.2 host.

PPM power injection.

Probe points for selected sidebands.

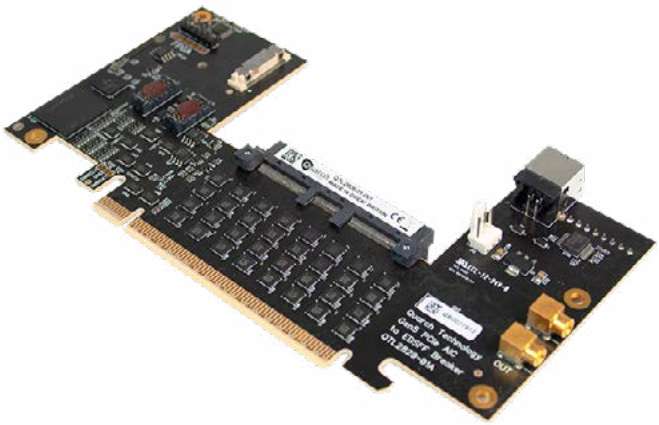
Direct USB control port in addition to Torridon controller.

External 12V PSU for drive supply.

Asymmetric breakers

GEN5 AIC TO EDSFF ASYMMETRIC BREAKER

Find out more



Supports EDSFF devices up to x16. Versions available with lower lane widths.

Optional triggering version with in/out trigger points.

Optional PAM connector to add power and sideband analysis

Direct USB control port in addition to Torridon controller.

CABLE BREAKER BENEFITS

Perform hot-plug and physical layer injection testing on a wide range of interconnect cables.

Test high speed data interconnects and control ports to maximise test coverage.

Many modules are rack-mountable to ease cabling.

Cable breakers mirror the feature set of other breakers and so can be quickly added to existing test automated test plans.

Cable breakers

24G MINI SAS HD CABLE BREAKER

Find out more

Supports SFF-8674 cables for external HD SAS interconnects up to 24G speeds.

44cm removable cable to connect to Torridon Controller.

Up to 4 units can be rack mounted in 1U.

SAS BREAKER: INDIVIDUAL RF SWITCHES ON EACH OF THE 4 SAS LANES. SIDEBAND SWITCHING FOR VMAN, VACT_0, VACT_1, MODPRSL, SDA, SCL, INTL. ACCESS TO EEPROM REGISTERS ON ACTIVE CABLES.

GEN4 EXTERNAL PCIE CABLE BREAKER

Find out more

Supports SFF-8644 cables for external PCIe interconnects up to Gen5 speeds.

44cm removable cable to connect to Torridon Controller.

Up to 4 units can be rack mounted in 1U.

PCIE BREAKER: INDIVIDUAL RF SWITCHES ON EACH OF THE 4 PCIE LANES. SIDEBAND SWITCHING FOR .PWR_B1, PWR_D1, CMI_SCL, CMI_SDA, CBL, PRSNT, MGT, PWR, CADDR, CINT. FULLY WIRED CUSTOM CABLE PROVIDED TO ENSURE THE BREAKER IS FULLY TRANS-PARENT /WHEN IN USE. DRIVE+MONITOR: CADDR, CINT. MONITOR: CMI_SCL, CMI_SDA, CBL_PRSNT, MGT_PWR.

Cable breakers

GEN4 OCULINK CABLE BREAKER

Find out more

Supports SFF-8611 cables for external interconnects up to Gen4 speeds.

44cm removable cable to connect to Torridon Controller.

Up to 4 units can be rack mounted in 1U.

OCULINK BREAKER: INDIVIDUAL RF SWITCHES ON EACH OF THE 4 LANES. SIDEBAND SWITCHING FOR: VACT_1, VACT_2, VSP_PL, VSP_MN,CWAKE, SMDAT, SMCLK, PERST, CPRSNT, RSVD_A9.

SFP28 CABLE BREAKER

Find out more

Supports SFP cables up to SFP28 speeds. Designed for compatibility with SFP56.

44cm cable to connect to Torridon Controller.

'Inline' form factor, plugging into the host
and extending the receptacle.

SFP28 BREAKER: INDIVIDUAL RF SWITCHES FOR THE DATA LANE. SUPPORTS ALL PROTOCOLS THAT FOLLOW THE SFP28 ELECTRICAL SPECIFICATION. SIDEBAND SWITCHING FOR: VCC_TX, VCC_RX, MOD_ABS, SDA, SCL, TX_FAULT, TX_DISABLE, RX_LOS, RS0, RS1.

Cable breakers

QSFP28 CABLE BREAKER

Find out more

Supports QSFP cables up to QSFP28 speeds. Designed for compatibility with QSFP56.

44cm cable to connect to Torridon Controller.

'Inline' form factor, plugging into the host and extending the receptacle.

QSFP28 BREAKER: INDIVIDUAL RF SWITCHES FOR ALL 4 DATA LANES. SUPPORTS ALL PROTOCOLS THAT FOLLOW THE QSFP28 ELECTRICAL SPECIFICATION. SIDEBAND SWITCHING FOR: VCC_TX, VCC_RX, VCC_1, MOD_PRSL, SDA, SCL, INTL, RESETL, MODSELL, LPMODE.

RJ-45 CABLE BREAKER

Find out more

Supports 10/100/1000 Base-T devices.

44cm cable to connect to Torridon Controller.

Triggering option available

RJ-45 BREAKER: INDIVIDUAL RF SWITCHES FOR THE DATA LANES. SUPPORTS 10/100/1000 BASE-T. DATA SWITCHING ONLY, POE WILL NOT PASS THROUGH. TRIGGERING VERSION AVAILABLE FOR SYNC WITH EXTERNAL DEVICES.

Cable breakers

USB 3.0 CABLE BREAKER

Find out more

Supports USB devices up to USB 3.0 speeds.

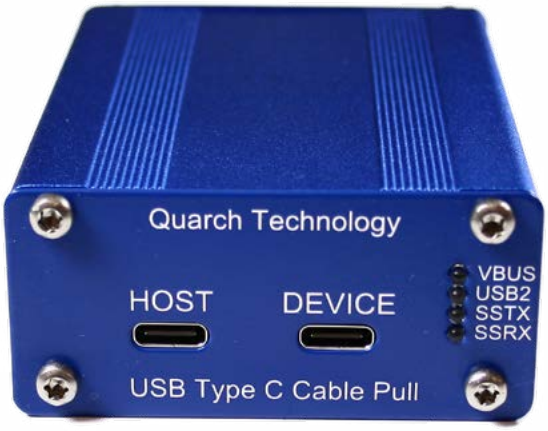
44cm cable to connect to Torridon Controller.

Individual switching for USB-3, USB-2 and VBUS.

USB 3.0 BREAKER: INDIVIDUAL RF SWITCHES FOR ALL USB LANES. FET SWITCHING FOR POWER.

USB 3.1 TYPE-C CABLE BREAKER

Find out more



Supports Low Speed, Full Speed, High Speed, Super Speed and Super Speed Plus devices.

44cm cable to connect to Torridon Controller.

Individual switching for USB-3, USB-2 and VBUS.

USB TYPE-C BREAKER: INDIVIDUAL RF SWITCHES FOR ALL USB LANES. FET SWITCHING FOR POWER.

Cable breakers

-48V DC TELECOMS BREAKER

Find out more

Supports power switching of -48V power to telecoms devices.

44cm cable to connect to Torridon Controller.

Fitted with ELCON Mini 2-pin connectors.

Triggering option available.

-48V BREAKER: FET SWITCHING FOR 48V_POWER, SIDEBANDS: DETECT_1, DETECT 2. SUPPORTS UP TO 20A AT -48V. VOLTAGE TOLERANCE FROM -25 TO -72V.

MULTI-PROTOCOL AUTOMOTIVE BREAKER

Find out more

Supports USB-2, RS-232, RS-422, RS-485, CAN/LIN, I2C and 1000Base-T1.

Switches 4 data lanes and one power rail.

Pluggable screw terminals for quick connection.

External triggering via MCX.

Cable breakers

Find out more

Direct USB and LAN ports (no Torridon controller required).

Power from 12v or PoE.

Capture bus transactions with up to 1MHz sampling.

MULTI-PROTOCOL BREAKER: ANALOG SWITCHING SUPPORTS MANY PROTOCOLS THAT HAVE A SIGNAL RANGE WITHIN -15V TO +15V ANDBANDWIDTH OF LESS THAN 460 MHZ. FOR CAPTURE, BUS TRANSACTIONS ARE DIGITALLY SAMPLED AT 1MHZ MAX WITH CONFIGURABLE AVERAGING.

Find out more

SSD TESTING SOLUTION

This enclosure-based tester from Quarch combines all the major elements you need to test an SSD:

- Full control of data lanes, power, and sidebands (As with our breakers)
- Power and digital sideband capture (As with our PAM range)
- Power injection port for voltage margining (with a PPM)
- Controllable cooling

Putting this all into a single tester allows us to combine all the features while minimising the signal path. There is no re-driving or re-timing in the PCIe signal path, so the SSD can be tested as if it were directly connected to the host.

Desktop Drive Enclosure

The enclosure is designed to connect to a Serial Cables host card or another MCIO-based controller.

A huge range of tests can be run (and easily automated):

- Hot-plug timing sequences, including pin-bounce
- Sideband failure
- Lane width restriction
- Data and sideband glitch
- Power loss, brownout, and crowbar
- Power Vs Performance capture
- Sideband capture and debugging